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(72) Inventors:
• **Wiegner, Dirk**
71409 Schwaikheim (DE)
• **Luz, Gerhard**
74321 Bietigheim-Bissingen (DE)

(74) Representative: **Kohler Schmid Möbus**
Patentanwälte
Ruppmannstraße 27
70565 Stuttgart (DE)

(71) Applicant: **Alcatel Lucent**
75007 Paris (FR)

(54) **Efficiency-improved doherty amplifier arrangement**

(57) The invention relates to a Doherty amplifier arrangement (1) for amplification of an RF signal (S_{in}), comprising: a main amplification path (2a) with a main amplifier (3), a main amplifier control unit (9) for switching a supply voltage (V_{ds}) of the main amplifier (3) in dependence of a load condition of the Doherty amplifier arrangement (1), an auxiliary amplification path (2b) with a peak

amplifier (4), and a peak amplifier control unit (8) for modulating an input supply voltage (V_{gs}) of the peak amplifier (4) in dependence of an envelope of the input signal (S_{in}). Further aspects of the invention relate to a transmit frontend (11) and to a base station (12) for such a transmit frontend (11), as well as to a corresponding amplification method.

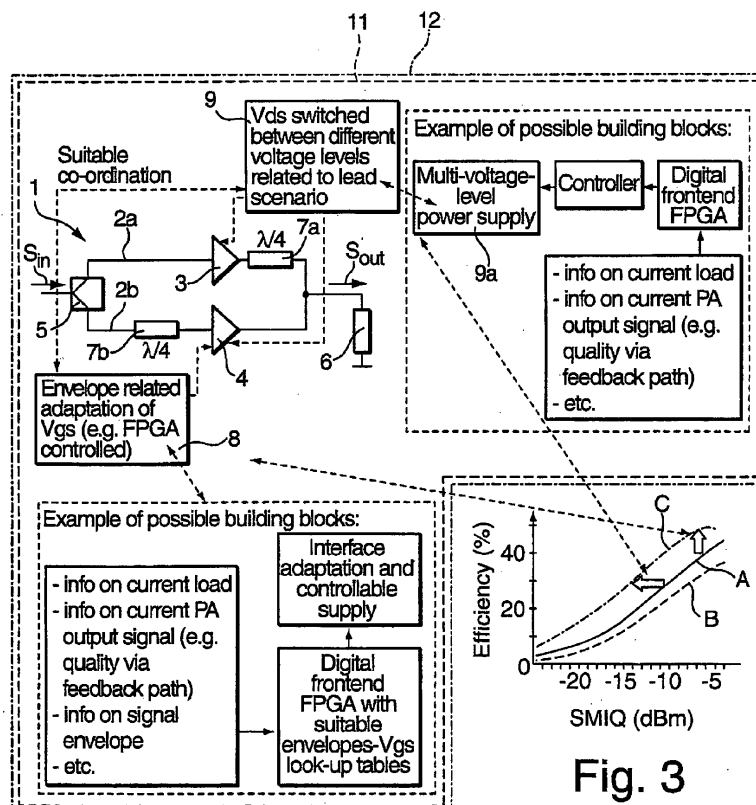


Fig. 3

Description

Field of the Invention

[0001] The invention relates to the field of telecommunications, and, more specifically, to efficiency improvements of Doherty amplifiers used for signal amplification e.g. in base stations of wireless communications networks.

Background

[0002] This section introduces aspects that may be helpful in facilitating a better understanding of the invention. Accordingly, the statements of this section are to be read in this light and are not to be understood as admissions about what is in the prior art or what is not in the prior art.

[0003] Doherty amplifiers typically comprise two parallel amplification paths for an input signal: A main amplification path with a main amplifier biased to work in class A/B mode, and an auxiliary amplification path with a peak amplifier biased to operate in class C mode, as well as two quarter-wave sections, each being arranged in a respective amplification path. In the Doherty amplifier configuration, during high signal peaks of the input signal, the main amplifier saturates and the peak amplifier takes over. Thus, a Doherty amplifier provides a high power-added efficiency with input signals that have high peak-to-average ratios.

[0004] Yet, although a theoretical efficiency of a Class-A (50 % peak efficiency) and a Class-B (78 % peak efficiency) based Doherty amplifier is quite good also for high back-off conditions (e.g. about 50 % or less of the maximum possible power), experiments show that the actual efficiency of a Doherty amplifier clearly differs from the theoretically expected efficiency. This is e.g. due to the fact that the auxiliary amplifier is permanently biased in Class-C mode and thus doesn't always deliver the optimum required performance for a Doherty configuration.

[0005] On a concept level, one approach for improving efficiency would be switching a supply voltage (drain-source voltage when a Field Effect Transistor (FET) is used) of the main amplifier depending on the load condition (e.g. daytime - nighttime), or alternatively adapting the input supply voltage (gate-source voltage for a FET) of the peak transistor. Both mentioned approaches improve efficiency, but still with clear room for improvement as compared to the theoretical Doherty limits. On the other hand, concepts like Envelope Tracking based on bias modulation of conventional Class-AB amplifiers are known, supplying the Class-AB amplifier with a modulation voltage depending on the envelope signal and the load condition of the Class-AB amplifier. However, when the Envelope Tracking solution is chosen, a specific supply voltage modulator is required which is challenging to implement.

Summary

[0006] The present invention is directed to addressing the effects of one or more of the problems set forth above.

The following presents a simplified summary of the invention in order to provide a basic understanding of some aspects of the invention. This summary is not an exhaustive overview of the invention. It is not intended to identify key or critical elements of the invention or to delineate the scope of the invention. Its sole purpose is to present some concepts in a simplified form as a prelude to the more detailed description that is discussed later.

[0007] One aspect of the invention relates to a Doherty amplifier arrangement for amplification of an RF signal, comprising: a main amplification path with a main amplifier, a main amplifier control unit for switching a supply voltage of the main amplifier in dependence of a load condition of the Doherty amplifier arrangement, an auxiliary amplification path with a peak amplifier, and a peak amplifier control unit for modulating an input supply voltage of the peak amplifier in dependence of an envelope of the input signal.

[0008] The inventors propose to combine switching the (output) supply voltage of the main amplifier and typically also of the peak amplifier between different discrete values in dependence of the load (realizing a comparatively slow adaptation) with a signal-envelope related modulation of an input supply voltage provided to the peak amplifier (realizing a comparatively fast adaptation with quasi-continuous voltage levels). By combining both approaches, the efficiency at low to high back-off operation (i.e. for different load situations) as well as the peak efficiency of the Doherty amplifier arrangement can be improved. Thus, a common Doherty amplifier concept can be realized which leads to an additionally improved efficiency as compared to the single approaches.

[0009] In one embodiment, the peak amplifier control unit is adapted for modulating the input supply voltage of the peak amplifier also in dependence of a load condition and/or of a quality of an output signal of the Doherty amplifier arrangement. Thus, in addition to the dependence on the envelope signal, the input supply voltage may also be chosen in dependence of the load condition and/or on the output signal of the Doherty amplifier. Thus, instead of using a single characteristic function for mapping amplitude values of the envelope signal to values of the input supply voltage of the peak amplifier, a plurality of functions may be used, each function being defined for a different load condition / quality of the output signal. In this respect, it should be noted that when a feedback path is implemented in the Doherty amplifier arrangement, e.g. for digital pre-distortion, the knowledge of the output signal will be available in the Doherty amplifier arrangement anyhow, such that no additional components will be needed for detecting the amplified signal at the amplifier's output.

[0010] In one embodiment, the Doherty amplifier arrangement is adapted for switching the supply voltage of

the main amplifier and for modulating the input supply voltage of the peak amplifier in a coordinated way. Typically, the supply voltage of the main amplifier (and of the peak amplifier) as well as the input supply voltage of the peak amplifier are switched / adapted in dependence of the load, resulting in a load-dependent coordination of both approaches. For instance, for each discrete value of the supply voltage of the main/auxiliary amplifier (typically corresponding to a different load scenario chosen from a discrete set of load scenarios), a different relation / function relating the envelope signal to the input supply voltage may be used.

[0011] In another embodiment, at least one of the peak amplifier control unit and the main amplifier control unit are further adapted for switching an output supply voltage of the peak amplifier in dependence of a load condition of the Doherty amplifier arrangement. Typically, the output supply voltage (e.g. drain-source voltage of a FET) of the peak amplifier will be switched only in dependence of the load condition, i.e. the output supply voltage will also be chosen from a discrete set of values (in general not more than ten values, typically five or less values, corresponding to different load scenarios).

[0012] In a further embodiment, the peak amplifier control unit comprises at least one look-up table relating the input supply voltage to the envelope of the input signal. As the adaptation of the input supply voltage has to be performed in a rapid way, a look-up table may be used for quickly determining a current value of the input supply voltage from a plurality of parameters (signal envelope, load, possibly output signal quality).

[0013] In one improvement, the Doherty amplifier arrangement comprises a plurality of look-up tables, each for a different load condition of the Doherty amplifier arrangement. For instance, three look-up tables may be provided a first one for a low load scenario, a second one for a mid load scenario, and a third one for a high load scenario, respectively. The look-up tables may be implemented e.g. in a Field Programmable Gate Array, FPGA, or other suitable device. Following the look-up table, a suitable interface adaptation and an adaptive power supply may be used to provide the adaptive input supply voltage to the peak amplifier. It will be understood that in addition to the load, further input parameters may be provided, so that a plurality of look-up tables may be used, each look-up table corresponding to a specific combination of the input parameters.

[0014] In another embodiment, the main amplifier control unit comprises a switchable power supply for generating a plurality of discrete voltage levels to be provided as supply voltages to the main amplifier. For instance, for the low, mid, and high load scenario, a voltage level of e.g. 15 V, 20 V, or 30 V may be used. The switchable (DC) power supply may e.g. comprise a DC-to-DC converter for switching between the different voltage levels. Typically, the switching between the discrete voltage levels is performed at a switching frequency smaller than 100 kHz. The switchable power supply of the main am-

plifier control unit may also be used for providing the (output) supply voltage for the peak amplifier. In this case, the (output) supply voltage provided to the main amplifier and the peak amplifier will be identical and both will be switched e.g. between the three voltage levels of 15 V, 20 V, or 30 V, respectively.

[0015] A further aspect of the invention relates to a transmit frontend for a base station, comprising a Doherty amplifier arrangement as described above. The transmit frontend typically has a digital frontend unit which is adapted to generate a (digital) baseband signal which is Analog-to-Digital converted before being up-converted to the RF domain, the up-converted signal being provided to the Doherty amplifier arrangement as an input signal for amplification. The output signal after amplification will then be provided to an antenna for radio transmissions (via a suitable antenna network). As the digital frontend generates the input signal, the digital frontend typically has both the information about the load condition and the envelope of the input signal which is provided to the Doherty amplifier arrangement, such that it is ideally suited for implementing at least part of the main amplifier control unit and the peak amplifier control unit.

[0016] The transmit frontend is typically part of a base station for mobile radio applications, which is used in a wireless network e.g. of the LTE advanced standard, the Wimax standard, etc.

[0017] Another aspect of the invention is realized in a method for amplification of an input signal which is provided to a Doherty amplifier arrangement having a main amplifier and a peak amplifier, the method comprising: switching a supply voltage of the main amplifier in dependence of a load condition of the Doherty amplifier arrangement, and modulating an input supply voltage of the peak amplifier in dependence of an envelope of the input signal. As indicated above, combining a slow adaptation ("switching") of the (output) supply voltage of the main amplifier using only a small discrete set of supply voltage values with a faster (continuous or quasi-continuous) adaptation of the (input) supply voltage of the auxiliary amplifier may lead to a considerable efficiency improvement of the Doherty amplifier arrangement. Typically, the lower the load of the Doherty amplifier arrangement, the smaller the (output) supply voltage provided to the main amplifier.

[0018] In one variant, the modulating of the input supply voltage of the peak amplifier is performed also in dependence of a load condition and/or of a quality of an output signal of the Doherty amplifier arrangement. In particular, the modulation of the input supply voltage may be different for different (typically discrete) load scenarios. Also, the quality (e.g. linearity) of the output signal may be taken into account for the modulation, e.g. in order to avoid a decrease of the output signal linearity.

[0019] In another variant, the switching of the supply voltage of the main amplifier and the modulating of the input supply voltage of the peak amplifier are performed in a coordinated way. In particular, when both supply volt-

ages are load-dependent, the load is a parameter which influences both supply voltages, such that both supply voltages will be coordinated based on the load.

[0020] In yet another variant the method further comprises: switching an output supply voltage of the peak amplifier in dependence of a load condition of the Doherty amplifier arrangement. The output supply voltage of the peak amplifier may be switched in an analogous way as the output supply voltage of the main amplifier, i.e. the value of the output supply voltage may decrease with decreasing load.

[0021] In one variant, the method further comprises: relating the input supply voltage to the envelope of the input signal using at least one look-up table, preferably using a plurality of look-up tables for different load conditions (or other conditions) of the Doherty amplifier arrangement. The envelope signal of the input signal provided to the Doherty amplifier may be determined e.g. in a digital frontend which may be implemented e.g. as an FPGA, a look-up table being used for quickly relating a current value of the envelope signal to an adequate input supply voltage for the peak amplifier.

[0022] A final aspect of the invention is implemented in a computer program product adapted to perform all the steps of the method described above, the computer program product being implemented in suitable software and/or hardware.

[0023] Further features and advantages are stated in the following description of exemplary embodiments, with reference to the figures of the drawing, which shows significant details, and are defined by the claims. The individual features can be implemented individually by themselves, or several of them can be implemented in any desired combination.

Brief Description of the Figures

[0024] Exemplary embodiments are shown in the diagrammatic drawing and are explained in the description below. The following are shown:

- Fig. 1** shows a schematic diagram of an Doherty amplifier arrangement according to the state of the art,
- Fig. 2** shows a schematic diagram of the load-dependent efficiency of the Doherty amplifier of Fig. 1,
- Fig.3** shows a schematic diagram of an embodiment of a Doherty amplifier arrangement according to the invention, and
- Fig.4** shows an exemplary scenario of a supply voltage / bias adaptation which is implemented in the Doherty amplifier arrangement of Fig. 3.

Description of the Embodiments

[0025] The functions of the various elements shown in the Figures, including any functional blocks labeled as 'processors', may be provided through the use of dedicated hardware as well as hardware capable of executing software in association with appropriate software. When provided by a processor, the functions may be provided by a single dedicated processor, by a single shared processor, or by a plurality of individual processors, some of which may be shared. Moreover, explicit use of the term 'processor' or 'controller' should not be construed to refer exclusively to hardware capable of executing software, and may implicitly include, without limitation, digital signal processor (DSP) hardware, network processor, application specific integrated circuit (ASIC), field programmable gate array (FPGA), read only memory (ROM) for storing software, random access memory (RAM), and non volatile storage. Other hardware, conventional and/or custom, may also be included. Similarly, any switches shown in the Figures are conceptual only. Their function may be carried out through the operation of program logic, through dedicated logic, through the interaction of program control and dedicated logic, or even manually, the particular technique being selectable by the implementer as more specifically understood from the context.

[0026] The classical configuration of a conventional Doherty (power) amplifier arrangement **1** is shown in **Fig. 1**. The Doherty amplifier **1** comprises a main amplification path **2a** with a main amplifier **3** biased to work in class A, AB or class B mode, and an auxiliary amplification path **2b** with a peak amplifier **4** biased to operate in class C mode. A power divider (passive splitter **5**) splits an input signal S_{in} with equal power to the main amplification path **2a** and to the auxiliary amplification path **2b**. After amplification, the auxiliary amplification path **2b** and the main amplification path **2a** are re-combined in a power combiner (not shown) at a combining point (represented by a dot in Fig. 1) while guaranteeing suitable output load modulation.

[0027] For optimized load balancing, a first quarter wave section **7a** is arranged in the main amplification path **2a** between an output terminal of the main amplifier **3** and the combining point and a second quarter wave section **7b** is arranged in the auxiliary amplification path **2b** between the splitter **5** and an input terminal of the auxiliary / peak amplifier **4**. The quarter-wave sections **7a**, **7b** are matched to a common center frequency of the main amplifier **3** and the peak amplifier **4** which are both adapted to operate at that center frequency by respective input and output matching networks (not shown). During high signal peaks of the input signal S_{in} , the main amplifier **3** saturates and the peak amplifier **4** takes over, thus generating an amplified output signal S_{out} being provided to a load **6** (not being part of the arrangement).

[0028] The Doherty amplifier arrangement **1** of Fig. 1 provides a high power-added efficiency with input signals S_{in} that have high peak-to-average ratios. However, al-

though the theoretical efficiency characteristic of a Class-A (50 % peak efficiency) and Class-B (78 % peak efficiency) based Doherty is quite good, a measured efficiency characteristic of a Doherty amplifier arrangement, mainly based on the classical concept (curve **A**: Drain efficiency of Doherty amplifier, and for comparison reasons curve **B**: balanced-mode operation (both, main and peak transistors are operated in Class-A or B mode)) in dependence of the signal power (output of a SMIQ modulator in dBm) shown in **Fig. 2** differs from (i.e. is smaller than) the theoretically expected efficiency, e.g. due to the fact that the auxiliary amplifier 4 is permanently biased in Class-C mode and thus doesn't always deliver the optimum required performance for a Doherty amplifier arrangement.

[0029] In order to improve the efficiency of the Doherty arrangement 1 of Fig. 1, the classical Doherty amplifier arrangement 1 needs to be modified. **Fig. 3** shows an exemplarily embodiment of such a modified Doherty amplifier arrangement 1, additionally comprising a peak amplifier control unit 8 and a main amplifier control unit 9. It will be understood that the main amplifier control unit 9 is not restricted to controlling only the main amplifier 3, but may also be used for performing part of the control of the peak amplifier 4. In particular, both the main amplifier control unit 9 and the peak amplifier control unit 8 may be integrated into a single physical entity.

[0030] The main amplifier control unit 9 is adapted for switching an (output) supply voltage V_{ds} of the main amplifier 3 between different (discrete) voltage levels in dependence of the input signal load. The peak amplifier control unit 8 is provided for modulating (adaptively controlling) an input supply voltage V_{gs} of the peak amplifier 4 in dependence of an envelope of the input signal S_{in} and also in dependence of the (current) load. By combining both approaches, and applying them to the classical Doherty amplifier concept, an improved peak and back-off efficiency of the resulting advanced Doherty amplifier may be attained, as indicated by the illustrative improved efficiency curve **C** of the efficiency diagram of Fig. 3. Both amplifiers 3, 4 (resp. power transistors arranged therein) may be controlled from a digital part / frontend (e.g. FPGA), which is adapted to provided the input signal S_{in} to the Doherty amplifier arrangement 1 (after digital-to-analog conversion and possibly up-conversion) and thus has knowledge both about the load situation and about the envelope of the input signal S_{in} . In the following, the control of the main amplifier 3 and of the peak amplifier 4 will be described in greater detail.

[0031] In the present example, the main amplifier 3 comprises a Field Effect Transistor, FET, and the main amplifier control unit 9 is adapted for controlling an output supply voltage V_{ds} which represents a voltage between a drain and a source terminal of the FET. In the present example, the main amplifier control unit 9 is also used for controlling the output supply voltage V_{ds} of the peak amplifier 4 in a coordinated way. In particular, the output supply voltages V_{ds} provided to the main amplifier 3 and

the peak amplifier 4 may be chosen to be identical. It will be understood that the approach described herein is not limited to the use of FETs, and may also be applied e.g. to bipolar transistors in an analogous way. As usual, the load of the Doherty amplifier arrangement is defined as a difference (typically measured in dB, dBm or %) from a maximum possible power which can be provided by the amplifiers 3, 4.

[0032] Each of the different discrete levels of the output supply voltage V_{ds} is related to a different load scenario, defined as a respective (different) range of the load of the Doherty arrangement 1. For instance, there may be three discrete voltage levels e.g. of 15 V, 20 V, and 30 V which are provided to the main amplifier 3 by a multi-voltage-level power supply 9a. As indicated above, each voltage level may correspond to one of three different load conditions, e.g. low load, mid load, full load, being related to e.g. from 10 % to 40 %, from 40 % to 70 %, and from 70 % to 100 % of the full power of the Doherty arrangement 1.

[0033] In order to control the output supply voltage V_{ds} of the main amplifier 3, apart from the switchable power supply 9a, basic examples of further building blocks of the main amplifier control unit 9 are given in Fig. 3. For instance, in addition to the digital frontend already described above, a controller may be provided for switching between the different voltage levels of the power supply 9a. It will be understood that in addition to the information about the current load, further information, e.g. about a current quality of the output signal S_{out} of the Doherty amplifier arrangement 1, may be provided to the digital frontend and taken into account for controlling the main amplifier 3. The output signal may be provided to the digital frontend e.g. using a tap coupler at the output of the Doherty arrangement 1 (not shown) which may be part of a feedback-path for performing (digital) pre-distortion of the input signal S_{in} .

[0034] For controlling the input supply voltage V_{gs} of the peak amplifier 4; being defined in the present example as a voltage between a gate terminal and a source terminal of a FET of the peak amplifier 4, building blocks of the peak amplifier control unit 8 may e.g. comprise one or more suitable look-up tables in the digital frontend (FPGA), relating a current value of the envelope of the input signal S_{in} to the input supply voltage V_{gs} of the peak amplifier 4. Also, a suitable interface adaptation and adaptive power supply or another suitable voltage modulator may be provided to supply the adaptive input voltage V_{gs} to the peak amplifier 4. As for the main amplifier control unit 9, further input parameters may have an influence on the input supply voltage V_{gs} , for example information about a current output signal quality of the Doherty amplifier arrangement 1, and, in particular, about a (current) load of the Doherty amplifier arrangement 1.

[0035] The Doherty amplifier arrangement 1 of Fig. 3 may be used e.g. in a transmit frontend 11 of a base station 12 of a communications network (not shown), the transmit frontend 11 further comprising at least one trans-

mit antenna for radio transmissions of the output signal S_{out} . The transmit frontend 11 may in particular also comprise the digital frontend described above and further components such as digital-to-analog converters and mixers.

[0036] It will be understood that the two parameters - output supply voltage V_{ds} of the main amplifier 3 - and input supply voltage V_{gs} of the auxiliary / peak amplifier 4 - are typically controlled in coordination to each other, as indicated by the double-headed arrow in Fig. 3. Thus, the two approaches for efficiency improvement may be combined to a common concept, a specific implementation example thereof being represented in Fig. 4.

[0037] In Fig. 4, the three different load scenarios (low load, mid load, high load) described above are used for the switching of the output supply voltage V_{ds} of the main amplifier 3. The switching of the output supply voltage V_{ds} in dependence of the load results in an optimized input supply voltage V_{gs} of the main amplifier 3. In a similar way, the output supply voltage V_{ds} of the peak amplifier 4 is also switched between (three) discrete voltage values, depending on the load condition, the switching of the output supply voltage V_{ds} of the peak amplifier 4 may be performed either in the peak amplifier control unit 8 itself, or alternatively in the main amplifier control unit 9. In this case, the same multi-voltage power supply 9a may be used for providing the same switched output supply voltage V_{ds} to both amplifiers 3, 4.

[0038] As can be gathered from Fig. 4, a set of look-up tables 10a to 10c may be provided, each relating the envelope of the input signal S_{in} to the input supply voltage V_{gs} of the peak amplifier 4 for a different load scenario. One skilled in the art will readily appreciate that although the present example has been given for three different load scenarios, an implementation using more or less than three load scenarios may be performed as well. In any case, the efficiency at back-off (supporting different load scenarios) as well as peak efficiency of the Doherty amplifier arrangement 1 may be improved by combining the two approaches in the way indicated above.

[0039] It should be appreciated by those skilled in the art that any block diagrams herein represent conceptual views of illustrative circuitry embodying the principles of the invention. Similarly, it will be appreciated that any flow charts, flow diagrams, state transition diagrams, pseudo code, and the like represent various processes which may be substantially represented in computer readable medium and so executed by a computer or processor, whether or not such computer or processor is explicitly shown.

[0040] Also, the description and drawings merely illustrate the principles of the invention. It will thus be appreciated that those skilled in the art will be able to devise various arrangements that, although not explicitly described or shown herein, embody the principles of the invention and are included within its scope. Furthermore, all examples recited herein are principally intended expressly to be only for pedagogical purposes to aid the

reader in understanding the principles of the invention and the concepts contributed by the inventor(s) to furthering the art, and are to be construed as being without limitation to such specifically recited examples and conditions. Moreover, all statements herein reciting principles, aspects, and embodiments of the invention, as well as specific examples thereof, are intended to encompass equivalents thereof.

Claims

1. Doherty amplifier arrangement (1) for amplification of an input signal (S_{in}), comprising:

a main amplification path (2a) with a main amplifier (3),
a main amplifier control unit (9) for switching a supply voltage (V_{ds}) of the main amplifier (3) in dependence of a load condition of the Doherty amplifier arrangement (1),
an auxiliary amplification path (2b) with a peak amplifier (4), and
a peak amplifier control unit (8) for modulating an input supply voltage (V_{gs}) of the peak amplifier (4) in dependence of an envelope of the input signal (S_{in}).

2. Doherty amplifier arrangement according to claim 1, wherein the peak amplifier control unit (8) is adapted for modulating the input supply voltage (V_{gs}) of the peak amplifier (4) also in dependence of a load condition and/or of a quality of an output signal (S_{out}) of the Doherty amplifier arrangement (1).

3. Doherty amplifier arrangement according to claim 1 or 2, being adapted for switching the supply voltage (V_{ds}) of the main amplifier (3) and for modulating the input supply voltage (V_{gs}) of the peak amplifier (4) in a coordinated way.

4. Doherty amplifier arrangement according to any one of the preceding claims, wherein at least one of the peak amplifier control unit (8) and the main amplifier control unit (9) is further adapted for switching an output supply voltage (V_{ds}) of the peak amplifier (4) in dependence of a load condition of the Doherty amplifier arrangement (1).

5. Doherty amplifier arrangement according to any one of the preceding claims, wherein the peak amplifier control unit (8) comprises at least one look-up table (10a to 10c) relating the input supply voltage (V_{gs}) to an envelope of the input signal (S_{in}).

6. Doherty amplifier according to claim 5, comprising a plurality of look-up tables (10a to 10c), each for a different load condition of the Doherty amplifier ar-

rangement (1).

the steps of the method according to any one of claims 10 to 14.

7. Doherty amplifier arrangement according to any one of the preceding claims, wherein the main amplifier control unit (9) comprises a switchable power supply (9a) for generating a plurality of discrete voltage levels to be provided as supply voltages (V_{ds}) to the main amplifier (3). 5
8. Transmit frontend (11) for a base station (12), comprising a Doherty amplifier arrangement (1) according to any one of the preceding claims. 10
9. Base station (12) for mobile radio applications comprising at least one transmit frontend (11) according to claim 8. 15
10. Method for amplification of an input signal (S_{in}) which is provided to a Doherty amplifier arrangement (1) having a main amplifier (3) and a peak amplifier (4), the method comprising: 20
 - switching a supply voltage (V_{ds}) of the main amplifier (3) in dependence of a load condition of the Doherty amplifier arrangement (1), and 25
 - modulating an input supply voltage (V_{gs}) of the peak amplifier (4) in dependence of an envelope of the input signal (S_{in}).
11. Method according to claim 10, wherein the modulating of the input supply voltage (V_{gs}) of the peak amplifier (3) is performed also in dependence of a load condition and/or of a quality of an output signal (S_{out}) of the Doherty amplifier arrangement (1). 30

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12. Method according to any one of claims 10 and 11, wherein the switching of the supply voltage (V_{ds}) of the main amplifier (3) and the modulating of the input supply voltage (V_{gs}) of the peak amplifier (4) are performed in a coordinated way. 40
13. Method according to any one of claims 10 to 12, further comprising:
 - switching an output supply voltage (V_{ds}) of the peak amplifier (4) in dependence of a load condition of the Doherty amplifier arrangement (1). 45
14. Method according to any one of claims 10 to 13, further comprising: 50
 - relating the input supply voltage (V_{gs}) to the envelope of the input signal (S_{in}) using at least one look-up table, preferably using a plurality of look-up tables (10a to 10c) for different load conditions of the Doherty amplifier arrangement (1). 55
15. Computer program product adapted to perform all

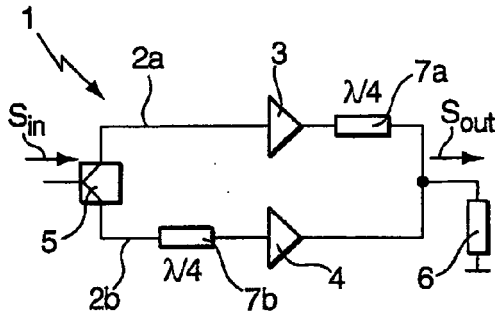


Fig. 1

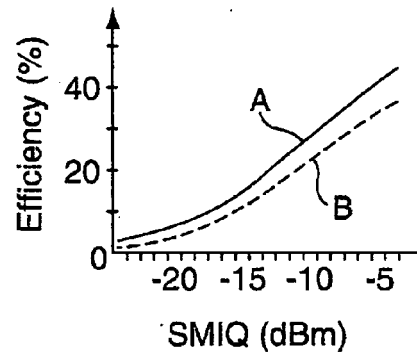


Fig. 2

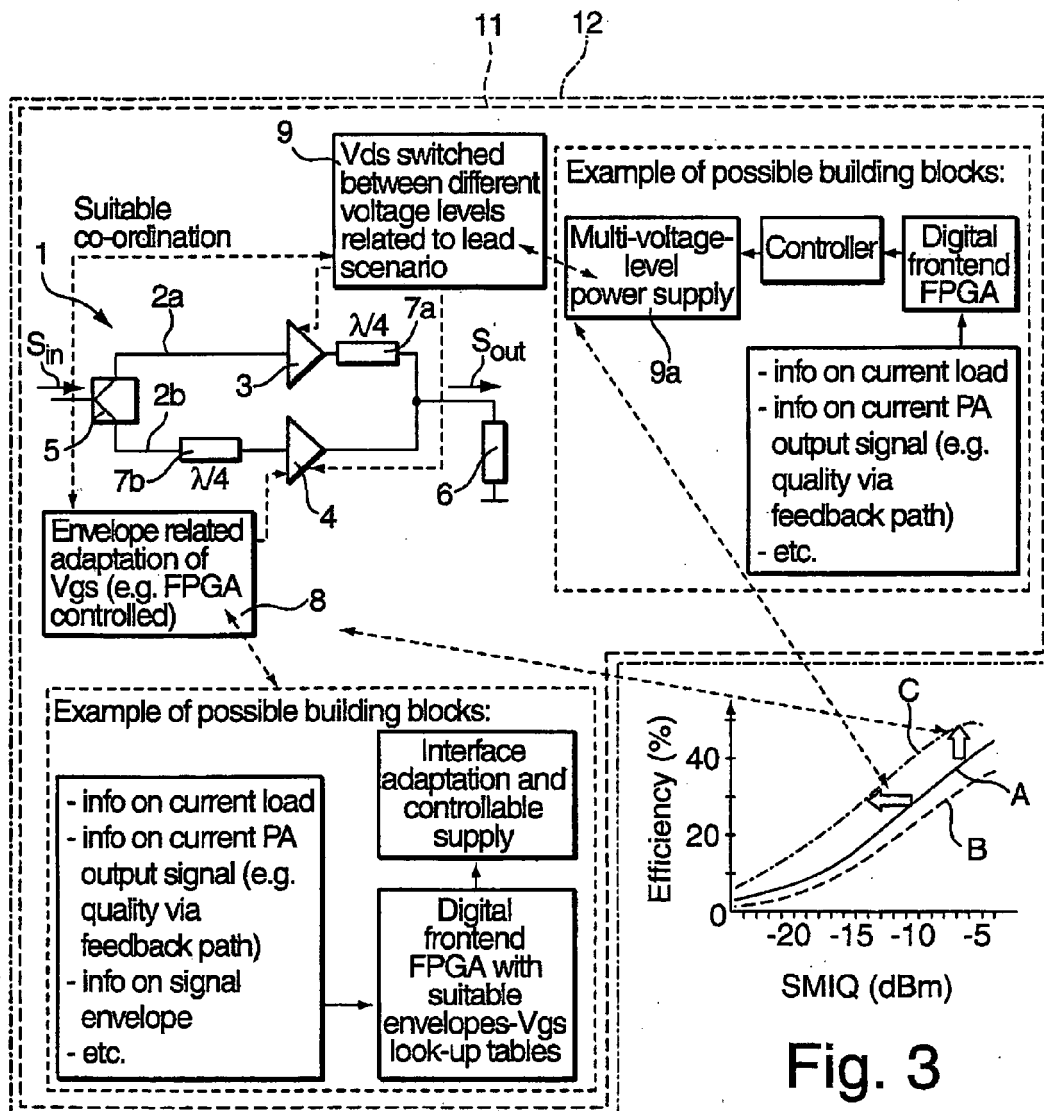


Fig. 3

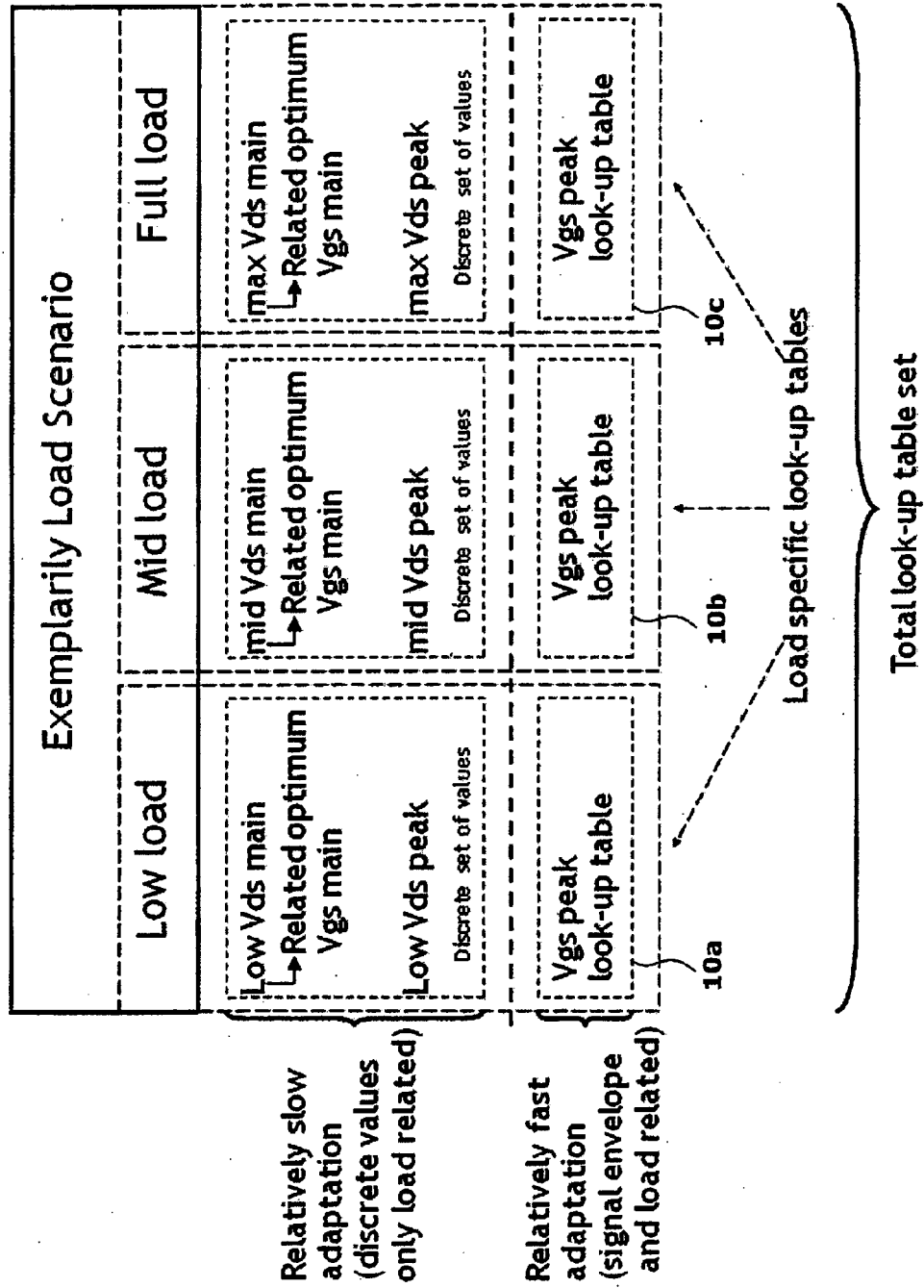


Fig. 4



EUROPEAN SEARCH REPORT

Application Number
EP 10 29 0175

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	EP 1 959 564 A2 (TELASIC COMM INC [US]) 20 August 2008 (2008-08-20) * paragraph [0033] - paragraph [0034]; figure 3 * * paragraph [0038] - paragraph [0059]; figures 6,7,8 *	1-15	INV. H03F1/02 H03F3/24 H03G3/00 ADD. H04W52/18
Y	JUNGHWAN MOON ET AL: "A Wideband Envelope Tracking Doherty Amplifier for WiMAX Systems" IEEE MICROWAVE AND WIRELESS COMPONENTS LETTERS, IEEE SERVICE CENTER, NEW YORK, NY, US LNKD- DOI:10.1109/LMWC.2007.912019, vol. 18, no. 1, 1 January 2008 (2008-01-01), pages 49-51, XP011199213 ISSN: 1531-1309 * page 50, right-hand column, line 18 - page 51, right-hand column, line 7; figures 4,5,6 *	1-15	
A	JOONGJIN NAM ET AL: "The Doherty Power Amplifier With On-Chip Dynamic Bias Control Circuit for Handset Application" IEEE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES, IEEE SERVICE CENTER, PISCATAWAY, NJ, US LNKD- DOI:10.1109/TMTT.2007.892800, vol. 55, no. 4, 1 April 2007 (2007-04-01), pages 633-642, XP011176523 ISSN: 0018-9480 * page 633, right-hand column, line 20 - page 636, left-hand column, line 21; figures 6,7 *	1-15	TECHNICAL FIELDS SEARCHED (IPC) H03F H03G
The present search report has been drawn up for all claims			
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Application Number
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